Environmental Science and Policy 94 (2019) 220–226

Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

Indigenous involvement in the Canadian species at risk recovery process

Cassandra J. Hill[a,b,*], Richard Schuster[a], Joseph R. Bennett[a]

[a] Carleton University Department of Biology, 209 Nesbitt Biology Building, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada
[b] Mohegan Tribe, Uncasville, CT, United States

ARTICLE INFO

Keywords:
Indigenous peoples
Consultation
Co-management
Species at risk act (SARA)
Expert elicitation
Aboriginal traditional knowledge (ATK)
Traditional ecological knowledge (TEK)
Conservation

ABSTRACT

Many countries, including Canada, are beginning to recognize the important roles of Indigenous Peoples in threatened species recovery. To determine whether official recognition is translating into actual involvement of Indigenous Peoples in species recovery planning in Canada, we examined recovery documents for species under the Canadian Species at Risk Act (SARA). We scored each document for the level of involvement with Indigenous Peoples on a scale of 0–5. We analyzed the data using permutation-based ANOVAs and post hoc pairwise permutation tests to determine the impact of region, taxonomic group, and responsible agency on scores. Fifty two percent of documents suggested no Indigenous involvement, despite a legal requirement to consult Indigenous Peoples to the extent possible. Documents for species in central Canada and Quebec indicated significantly lower involvement than in other regions. Documents for taxonomic categories such as mosses indicated lower involvement than those containing iconic and economically valuable taxa, such as fish and mammals. Documents coordinated by Environment and Climate Change Canada indicated significantly lower involvement than those coordinated by Parks Canada or Fisheries and Oceans Canada. These regional and taxonomic discrepancies, along with differences among agencies suggest short-term priorities for improving Indigenous Peoples' involvement in species at risk recovery planning in Canada.

1. Introduction

Indigenous perspectives have often been undervalued in conservation science (Colchester, 2004). Indigenous knowledge and perspectives are often seen by non-Indigenous people as less legitimate information in comparison to western science (Buchanan, 2016), which is likely an important cause of the lack of Indigenous involvement in national- or state-level conservation efforts (Walker, 2001). However, this is just one among many possible reasons for the absent or insufficient involvement of Indigenous Peoples in conservation projects led by external agencies such as national or state/provincial governments. Small, overworked administrations (Assembly of First Nations, 2010), as well as unclear guidelines for participation, and past negative experiences (Bains and Ishkanian, 2016; LeRoy et al., 2003) can all contribute to the lack of Indigenous involvement in conservation. In addition, Indigenous groups may be unwilling to participate in state-level processes that they feel may impinge on, or fail to recognize, their sovereignty. Uncertainties regarding locations of species in Indigenous territories may also lead to lack of consultation efforts on the part of external agencies, or lack of response to consultative efforts by Indigenous Peoples.

In Canada, Indigenous involvement has been neglected in many conservation efforts (Moore et al., 2017), despite the government's legal duty to consult with Indigenous Peoples when they may be affected by decisions or actions (Haida Nation vs. British Columbia, 2004). For example, in the Canadian Boreal Forest Agreement in 2010, First Nations voices on the use of their ancestral lands were largely ignored (Smith, 2015).

The Canadian Species at Risk Act was adopted in 2002 in order to protect and recover Canadian wildlife species (SARA, 2002). The arm's-length Committee on the Status of Endangered Wildlife in Canada (COSEWIC) first assesses a species at risk to be labeled Extirpated, endangered, threatened, or special concern, based on multiple factors contributing to its status in Canada. This assessment is non-binding, and is followed by further assessment by the Minister of Environment and Climate Change and the Canadian Endangered Species Conservation Council, along with public consultations. If a decision is made for the species to be listed, the planning process continues with the development of management plans for special concern species and recovery strategies for threatened and endangered species. Action plans are then developed as the next step in the recovery process for these species (SARA, 2002). Three agencies are responsible for managing species at risk and producing recovery documents for them: (Environment and Climate Change Canada (ECCC), Parks Canada, and Fisheries and Oceans Canada (DFO). The complete process of listing and managing

* Corresponding author at: 1521 Lincolnshire Dr, Champaign, IL, 61821, United States.
E-mail address: cassiehill@cmail.carleton.ca (C.J. Hill).

https://doi.org/10.1016/j.envsci.2019.01.017
Received 1 October 2018; Received in revised form 29 January 2019; Accepted 29 January 2019
Available online 06 February 2019
1462-9011/ © 2019 Published by Elsevier Ltd.

species under SARA is outlined in detail by Mooers et al. (2007, 2010); Findlay et al. (2009) and Raymond et al. (2018).

The legal duty to consult with Indigenous Peoples applies to both COSEWIC and SARA. SARA dictates that COSEWIC status assessments contain the "best available" Aboriginal Traditional Knowledge (ATK) into recommendations for listing (SARA, 2002, section 15.2). COSEWIC contains a subcommittee that is responsible for incorporating this knowledge into assessments. This subcommittee has clear guidelines for consultation that include recognition of the importance of Indigenous knowledge (COSEWIC, 2010). However, the guidelines on how to include Indigenous Peoples within actual management under SARA's recovery processes are vague. For each document (action plans, recovery strategies, and management plans) The Act states that the Aboriginal organizations that the Minister considers likely to be affected by the plan must be involved "to the extent possible" (SARA, 2002, sections 39.1, 48.1, and 66.1). The level of Indigenous involvement could range from trivial to substantial, as the phrase "to the extent possible" allows interpreters to decide what they deem to be possible in regard to seeking input from Indigenous Peoples. Furthermore, from a thorough search of the primary and grey literature, we have found no published government guidelines on how to document the process of consultation within the recovery documents.

This study aims to determine the general level of involvement of Indigenous Peoples in recovery planning for species at risk in Canada, and to find the geographical and taxonomic areas that require the most improvement in involving Indigenous Peoples. To do so, we analyzed the content of all national species at risk recovery strategies and management plans and developed a scoring system to quantify the level of Indigenous Peoples' involvement evident in the documents. We elicited expert opinions to substantiate the scoring system, and contacted authors of a subsample of documents to confirm levels of involvement. Specifically, our study addresses the following questions:

1 What is the level of involvement of Indigenous Peoples in species at risk recovery processes in Canada?
2 Does the region in which a species is found affect the level of involvement of Indigenous Peoples in that species' recovery process? If so, what region(s) have more evidence of involvement of Indigenous Peoples?
3 Does the taxonomic category of a species affect the level of involvement of Indigenous Peoples present in that species' recovery process? If so, which taxonomic groups have more evidence of involvement of Indigenous Peoples?
4 Has the level of involvement of Indigenous Peoples changed over time based on the publication dates of recovery documents?
5 Does the agency under which the species' recovery document was written affect the level of involvement of Indigenous Peoples? If so, which agency has more evidence of involvement of Indigenous Peoples?

We predicted that regions with more unsigned treaties and a particular history of court challenges around Indigenous rights (e.g. British Columbia), would have lower levels of Indigenous involvement. We predicted that taxonomic categories that contain many iconic species such as birds and mammals would have higher levels of evidence of Indigenous involvement as a result of these species receiving more conservation effort in general (Bonnet et al., 2002). We also predicted that evidence of involvement of Indigenous Peoples would be less frequent in freshwater aquatic and marine species, as many of these species are directly or indirectly affected by harvesting, and implementing an effective recovery plan may negatively affect income associated with these species (Findlay et al., 2009). As a result, Indigenous involvement could more likely be intentionally overlooked for these species, as it could further complicate recovery measures.

2. Methods

2.1. Document context analysis

We used the Canadian Species at Risk Act (SARA) public registry website to obtain species at risk recovery documents. Under SARA, some sub-species entities including populations are treated as 'species', and are referred to as 'species' herein. We read all recovery strategies and management plans for species from 2006 to 2017 with their SARA Schedule 1 status labeled as endangered, threatened, and special concern for evidence of involvement of Indigenous Peoples. Recovery strategies and management plans are created at the same point in the species recovery process, depending on if the species' status is endangered or threatened (recovery strategies) or special concern (management plans). We excluded action plans because there were relatively few of these documents, and most of the plans included multiple taxa, complicating comparisons, as there was usually no clarification on which species (if any) were subject of consultation with Indigenous Peoples.

We reviewed each document in its entirety for records of Indigenous involvement, with specific focus on the Preface, Acknowledgements, and Appendices, where nearly all records were found. After we searched each document, we used the "find" function to search for key words and phrases that may have suggested the involvement of Indigenous Peoples in each document. These words and phrases included: "Aboriginal", "First Nation", "nation", "Indian", "band", "Metis", "Indigenous", "Inuit", "tribe", "tribal", "council", "people", and "community". We reviewed all management plans and recovery strategies published on the SARA public registry up to December 2017. If both proposed and final documents were available, we reviewed final documents, but when only proposed versions were available, we reviewed them and used them for analysis.

We categorized a document as containing evidence of Indigenous involvement when it was clear that the involvement took place as part of the document's formation. The mere inclusion of what may be seen as Indigenous knowledge is not considered equivalent to meaningful consultation (Maritime Aboriginal Peoples Council, 2014) and therefore we did not count it as such. We also did not consider the following to be Indigenous involvement: references to species populations being found on government-recognized Indigenous lands, general statements of cultural significance or use (e.g. plants affected by First Nations fire regimes), future plans for collaboration with Indigenous Peoples, and past recovery efforts undertaken by Indigenous Peoples or organizations.

2.2. Scoring system development

We developed a scoring system to estimate the level of Indigenous Peoples' involvement in the recovery documents. We used expert elicitation to help construct and refine this scoring system, to ensure it was accurate and defendable. We sent a draft of the scoring system along with initial data sheets to eight professionals within the field of conservation biology with experience in Indigenous conservation. All eight persons provided positive feedback regarding the draft scoring system, as well as suggestions for follow-up described below.

The system categorized the level of Indigenous involvement using a six-point scale in which a score of zero represents no evidence of involvement at all and a score of five represents the highest level of collaboration. A score of zero could indicate no detectable effort put towards obtaining Indigenous involvement, or it could represent declined involvement on the part of the Indigenous person or group. We eliminated all clear cases of declined involvement from the data (see below for details).

We considered several situations to represent involvement of Indigenous Peoples. Many plans included a general statement in the acknowledgements thanking Aboriginal organizations for contributing

to the plan. Others were more specific, mentioning the name of the Indigenous organization or individual in the acknowledgements, preface, or a section in some of the documents entitled "Record of Consultation". In some cases, Indigenous Peoples were included as members of the recovery team, personally consulted, or served as technical advisors. We scored all of these instances using the criteria for each score listed in the complete scoring system in Appendix A of the online Supplementary material.

To examine the accuracy of the scoring system, we emailed the authors or listed contacts of ten randomly-selected documents from each score category (0–5, for a total of 60 contacts) a short survey asking them to provide their firsthand knowledge on the Indigenous involvement process in a specific document. These questions are provided in the online Supplementary Material.

From the 60 species recovery documents whose authors were contacted, we received seventeen responses. We received five responses in which the authors stated that they had no knowledge of the consultation process that happened during the formation of their document. Two authors responded that they were unwilling/unable to release information regarding Indigenous involvement or were unable to locate the information. We received one response for a document that was assigned a score of zero, which indicated involvement of one Indigenous organization by means of a letter and a meeting, though this was not stated within the document. We received two responses for a species document assigned a score of 1, meaning the document had a vague mention of Indigenous involvement. However, one of the survey responses indicated no Indigenous involvement at all and the other stated that First Nations "may" have attended presentations.

We received five responses for documents assigned a score of two, meaning specific Indigenous organizations/individuals were named, but their exact role was unclear in the document. All of these responses confirmed Indigenous involvement, with two stating that an Indigenous representative attended a meeting and provided information on the species and the other three describing comments received during the document's response period. We received one response for a species document assigned a score of three, meaning an Indigenous group was listed specifically along with the information they provided. The survey response supported the qualifications of the assigned score. We received no responses for documents assigned a score of four. We received one response for a species document assigned a score of five, indicating the highest level of involvement or co-authorship. The response only mentioned Indigenous interest in species recovery and implementation, although the document lists Indigenous representatives as recovery team members, along with Indigenous knowledge. Although these results suggest some uncertainty in the scores among individual species, they do not suggest directional bias in our scores.

2.3. Data processing

The data underwent several steps of elimination, resulting in the most interpretable data set possible (Fig. 1). First, we eliminated species whose ranges do not overlap government-recognized Indigenous lands. The species range maps were provided by Environment and Climate Change Canada (2017) and the "Aboriginal Lands of Canada" map was provided by Natural Resources Canada (2014). We used the Intersect tool in ArcMap 10.3.1 to create a layer showing the overlapping areas of government-recognized Indigenous lands and species ranges. We imported this intersect layer into R studio (version 0.98.507), to produce a list of species whose ranges intersect with government-recognized Indigenous lands. Aquatic and marine species were not included in the species range maps produced by Environment and Climate Change Canada, but were retained in the data to be analyzed. It is possible that some of these species may not overlap with government-recognized Indigenous lands.

We then removed instances of species for which Indigenous Peoples declined involvement in recovery planning, which initially resulted in a score of 0. Declined involvement was often indicated in recovery documents by statements to the effect that letters were sent to Indigenous groups/organizations, but no comments were received, or that Indigenous groups/organizations were invited to participate in the recovery efforts, but they declined. Only 9.8% of the plans indicated declined involvement. It is possible that some of the remaining documents with zero scores were a result of declined involvement, but it was not explicitly stated that the opportunity for involvement was declined.

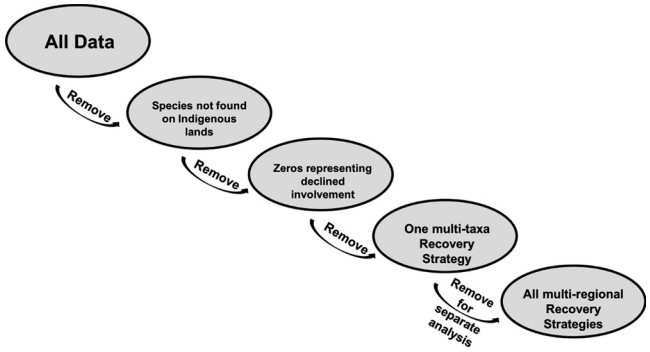

Fig. 1. Flow chart representing the steps taken to extract data for final analysis.

We included the majority of multi-species plans in the analysis as a single entry, as long as all of the species were in the same taxonomic category. We removed only one multi-species recovery strategy (Multi-species at Risk in Gary Oak Woodlands) from the analysis because it encompassed both plants and arthropods, and it was not clear which taxonomic group was the focus of the involvement with Indigenous Peoples.

2.4. Geographic and taxonomic categories

We sorted species by the taxonomic groups used in the SARA Registry (SARA, 2018): mammals, birds, reptiles, amphibians, fish, arthropods, molluscs, vascular plants, mosses, and lichens. We also categorized them according to the locations of their ranges by the following regions: Ontario, Quebec, Western Canada (British Columbia and the Pacific Ocean), central Canada (Saskatchewan, Alberta, and Manitoba), East Coast/Maritimes (Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador, and the Atlantic Ocean), and Northern/Arctic Canada (Yukon, Nunavut, Northwest Territories, and the Arctic Ocean).

We included species whose range included more than one geographical region in each individual occupied region. If there was an Indigenous group(s) involved in the species' document, we investigated the location of the group to determine if the score would remain the same for each region within the species' range, or only be applied to the region in which the involved Indigenous group is located. Therefore, some species documents were assigned different scores in each of their different regions. Because of potential problems of non-independence in this approach, we also conducted an additional analysis eliminating all species that appeared in multiple regions (see below).

2.5. Statistical analysis

Given that the data were not normally distributed (i.e., were zero-inflated with a defined maximum value), we used permutation based statistical tests (Anderson, 2001). To test for differences in score based on document type (recovery strategy or management plan), we used a pairwise permutation test. We then used a permutation based Analysis of Variance (ANOVA) to determine if there was a significant interaction between the document type and region, followed by the document type and taxonomic group.

To test for an interaction between region and taxonomic groups, we

used a permutation based ANOVA. As the interaction term was not significant ($p = 0.38$), we ran separate permutation based ANOVAs for regional groups and then for taxonomic categories. Then, to test for the differences among the categories for each of these variables, we ran pairwise permutation tests.

To test for differences in scores among responsible agencies, we first determined the agency responsible for each plan (ECCC, DFO, or Parks Canada). We then used a permutation based ANOVA followed by a pairwise permutation test to examine differences in scores between agencies. Additionally, we used a permutation based ANOVA to test for a significant interaction between agencies and regions. As this interaction term was significant (see Results below), we used a pairwise permutation test to test for significant differences in scores between each combination of agency and regional category. Results of this analysis are presented in Appendix B of the online Supplementary material. Because many taxonomic groups were not represented by certain agencies, we did not test for significant differences between agency and taxonomic scores, and agency was not included in the main model testing for differences among taxonomic groups.

To determine whether the level of involvement of Indigenous Peoples has changed over time based on the publication dates of recovery documents, we plotted the mean score for each year that recovery documents were published, and ran an ordinary least squares regression.

Given that some species were found in multiple regions, and there was thus some non-independence when counting these species for each region (despite the fact that scores could vary between regions), we conducted an additional analysis after removing all multi-regional plans. This decreased the number of documents from 477 to 257 (Figure A1 in the online Supplementary material). We ran permutation based ANOVAs on these data to test for overall significant differences among regions and among taxonomic groups. We then ran pairwise permutation tests to test for significant differences between regions followed by the same tests for taxonomic categories. Results of this analysis are presented in Appendix B of the online Supplementary material. All tests were conducted using R (version 3.3.4). We corrected the p-values for pairwise permutation tests for multiple comparisons using the Holm method (Holm, 1979).

3. Results

3.1. General patterns among all species

We found that 52% of all documents received a score of zero, meaning over half of all recovery documents included no detectable involvement of Indigenous Peoples. The central, Quebec, and western regions showed the highest percentages of zeros: over 50% of recovery documents for each of these regions had a score of zero (Table A1 in the Supplementary material).

Most recovery documents assigned a score of zero contained no mention of Indigenous Peoples. However, some of them did mention Indigenous Peoples, but did not mention any consultation/involvement. For example, the recovery documents for both the snapping turtle (*Chelydra serpentinea*) and wood turtle (*Glyptemys insculpta*) contained small paragraphs dedicated to describing the general cultural importance of all turtles, but no documentation of actual Indigenous involvement.

A score of one was assigned to 22% of all the recovery documents. This score represents a general statement of Indigenous involvement with no specifics describing information contributed and no Indigenous group/individual name listed. A score of two, representing specific clarification of the Indigenous group(s) involved, but no description of the input actually provided, was assigned to 6.9% of recovery documents. About 9% of recovery documents were assigned a score of three, representing specific Indigenous groups named, along with specifics about the information and perspectives they provided. A score of four, representing Indigenous Peoples/groups listed as editors and personal contacts for the document, was assigned to 3.6% of recovery documents. Only 6.5% of all recovery documents were assigned the highest score of five, representing evidence of meaningful involvement and co-management within the document. This was usually represented by naming Indigenous individuals or organizations as co-authors or major contributors in some way (see Appendix A in Supplementary material for details).

3.2. Regional and taxonomic variables

There was a significant difference in mean score between recovery strategies (mean: 1.23; ± 0.087 standard error (SE) and management plans (0.80 ± 0.11; $p = 0.0039$)). However, in permutation-based ANOVAs examining differences in mean scores, there was no significant interaction between the type of document and (1) region ($p = 0.18$) or (2) taxonomic group ($p = 0.73$) (refer to Table A3 & A4 in Supplementary material).

The interaction term between region and taxonomic group was not significant (Table A5 in Supplementary material). However, there were significant differences among regions ($p < 0.001$) and among taxonomic groups ($p < 0.001$). Central Canada and Quebec had the lowest mean scores of 0.39 (± 0.11 SE), and 0.70 (± 0.13 SE), respectively, while other regions had significantly higher mean scores (Fig. 2 & Table A6 in Supplementary material). Mosses, arthropods, and amphibians had the lowest mean scores of the taxonomic categories (Fig. 3). All recovery documents for mosses were assigned a score of zero for no involvement, while arthropods had a mean score of 0.44 (± 0.16 SE), and amphibians had a mean score of 0.80 (± 0.38 SE; Fig. 3 & Table A7 in Supplementary material). Mammals (1.94 ± 0.27) and fish (1.95 ± 0.26) had the highest mean scores.

3.3. Differences among management agencies

Documents for species for which DFO was the lead agency had the highest mean score at 2.18 (± 0.20 SE), while those from Parks Canada had a mean score of 1.55 (± 0.28 SE) and those from ECCC had the lowest mean score at 0.81 (± 0.067 SE). Pairwise permutation tests

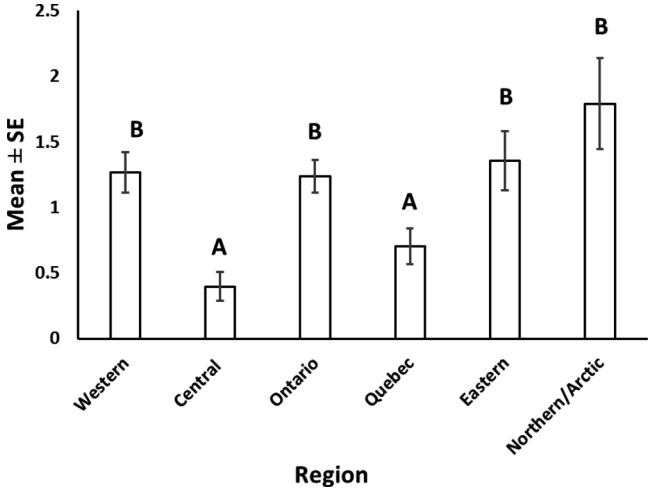

Fig. 2. Mean score for evidence of Indigenous involvement in recovery strategies and management plans by region (± standard error (SE)). The letters above each bar represent groupings based on significant differences in pairwise permutation tests. Western region (Pacific Ocean and British Columbia: n = 131), central region (Alberta, Saskatchewan and Manitoba: n = 68), Ontario (n = 134), Quebec (n = 64), eastern region (Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador, and the Atlantic Ocean: n = 56), Northern/Arctic region (Yukon, Nunavut, Northwest Territories, and the Arctic Ocean: n = 24).

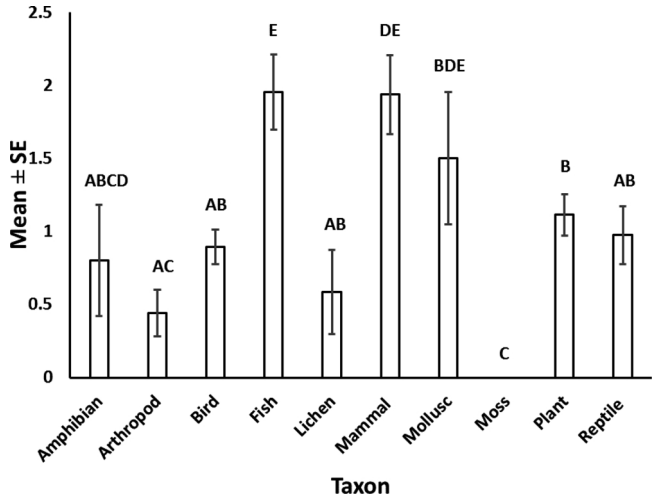

Fig. 3. Mean score for evidence of Indigenous involvement in recovery strategies and management plans by taxonomic category (± standard error (SE)). The letters above each bar represent groupings based on significant differences in pairwise permutation tests. Amphibians (n = 20), arthropods (n = 34), birds (n = 123), fish (n = 44), lichens (n = 12), mammals (n = 48), molluscs (n = 14), mosses (n = 20), plants (n = 123), reptiles (n = 39).

showed significant differences between scores of ECCC and DFO ($p < 0.001$), and ECCC and Parks Canada ($p < 0.001$). The mean score for DFO was marginally significantly different from that of Parks Canada ($p = 0.062$) (Figure A2 & Table A8 in Supplementary material).

The additional permutation based ANOVA to determine the relationships between agency and region resulted in a significant interaction term ($p < 0.001$) (Table A9 in Supplementary material.

3.4. Trends across time

The year that each document was published was not correlated with the score of Indigenous involvement ($r = 0.23$; $P = 0.47$; Figure A3 in Supplementary material).

3.5. Additional analysis – removing multi-regional species

In the additional analysis removing multi-regional species, results were similar to the main data set. There was no significant interaction between the taxonomic and regional categories ($p = 0.19$) (Table A11 in Supplementary material). Central Canada and Quebec remained the regions with the lowest scores for evidence of Indigenous involvement, and western Canada was no longer significantly different from these regions. The eastern and northern regions retained the highest mean scores (Figure A4 & Table A12 in Supplementary material). The mean score trends of the taxonomic analysis after removing species that were found in more than one region are comparable to the original analysis; however most taxonomic categories were not significantly different (refer to Figure A5 & Table A13 in Supplementary material).

4. Discussion

Over half (52%) of all the documents we analyzed were assigned a score of zero, indicating no evidence of involvement of Indigenous Peoples. These results are troubling, especially given the SARA's instructions to consult with Indigenous Peoples and incorporate ATK "to the extent possible". There are numerous possible reasons for no Indigenous involvement. One possible reason is that no comments were received. When documents stated that letters were sent to Indigenous groups/organizations and no response was received, they were removed from our analysis. However, some instances of this issue may remain in our data. In some cases, this problem can arise when a letter is sent to an office or person not equipped for making decisions of this nature (Joseph, 2015). Using only a letter as the method of contact is also problematic for Indigenous groups with small administrations that may be overworked and unable to respond in the required time frame (Assembly of First Nations, 2010). Despite our best efforts, it is difficult to conclusively determine if low scores are the result of lack of invitation or lack of Indigenous input provided after invitation. This is exacerbated by the fact that in many instances, there is no record of contact provided within recovery documents at all.

The often adversarial relationships between Indigenous Peoples and federal/provincial governments across Canada may also be a reason for little Indigenous involvement in the species recovery process. Ayers (2005) noted that some Indigenous Peoples are hesitant to become involved with development of marine protected areas (MPAs) because they feel it may risk their position in treaty processes. Corntassel (2007) suggested that Indigenous groups may also resist inclusion in externally-driven programs in general, because such programs may lead to co-optation into non-Indigenous led systems. In addition, the consultation process itself can be confusing to some Indigenous peoples (Bains and Ishkanian, 2016). Some Indigenous organizations have published guides to help alleviate this issue, by clarifying the recovery process and explaining how Indigenous Peoples can become involved (e.g. Assembly of First Nations, 2009). A history of insufficient consultations with Indigenous Peoples may also be a reason for either no involvement or declined involvement. This is demonstrated by LeRoy et al. (2003), who found that concerns about the establishment of an MPA were partially caused by inadequate consultations in the past. Providing clearer guidelines on Indigenous involvement within SARA and reassuring Indigenous Peoples of the value of their knowledge and perspectives may encourage more involvement in species at risk recovery.

Quebec and central Canada have the lowest levels of Indigenous involvement as well as the highest percentages of zero scores out of all the regions, with the Eastern, Northern, and Western regions, as well as Ontario, having significantly higher scores (Fig. 2). We had predicted that recovery documents for species found in Western Canada (which includes British Columbia and the Pacific Ocean) would have lower scores because of the large number of unsigned treaties in British Columbia, and therefore ill-defined boundaries of Indigenous land and its overlap with species at risk habitats. Our results do not support this hypothesis. Although the western region does have a higher percentage of zero scores than other regions, the plans that do show evidence of Indigenous involvement have relatively high scores.

The significant interaction between responsible agency and region may be a partial cause for low scores in specific regions. However, within ECCC, central Canada has a significantly lower mean score than the other regions (Table A10). This suggests that the cause of low scores in central Canada is not entirely a result of the high number of species in that region that are under the responsibility of ECCC.

It is difficult to determine the cause of the regional patterns we observed. One possibility is that Indigenous Peoples in central Canada and Quebec are less likely to have a stake in species at risk planning, due to lack of proximity to the species' habitats. However, we consider this possibility to be unlikely, for several reasons. First, we eliminated species whose ranges did not overlap with government-recognized Indigenous lands from our analysis. Second, the proportion of private land (where Indigenous Peoples cannot engage in many traditional land uses) is generally highest in Atlantic provinces (with the exception of Newfoundland, which is 95% Crown land). Third, the proportion of the population that is Indigenous is higher in central Canada than in most of Canada (Statistics Canada, 2016).

An additional possibility is that of greater racial bias in these areas, and its indirect influence of this on species at risk planning. Racial tension surrounding Indigenous Peoples in central Canada in particular has received considerable media attention (e.g. Macdonald, 2015). The Urban Aboriginal Peoples Study (2011) also suggests possibly of greater

racial tension in central Canada and Quebec, with Indigenous People's impressions of how they are perceived by others being lowest in cities in these areas. On the other hand, overall impressions of Indigenous Peoples regarding how they were perceived by others were low across the country (Urban Aboriginal Peoples Survey, 2011), suggesting that racial tensions are also prevalent outside of Western Canada and Quebec. In addition, our data cannot draw causal links between any possible regional differences in racial bias (if indeed they exist), and species at risk management. Thus, this possibility can be neither discounted nor strongly supported within the scope of our study.

Among taxonomic groups, fish received the highest mean score for Indigenous involvement, with mammals and molluscs having the next highest mean scores (Fig. 3). This contradicted our hypothesis that aquatic and marine species would have lower levels of Indigenous involvement. Many marine and aquatic species are economically important and are less likely to be listed under SARA (Findlay et al., 2009; Creighton and Bennett, unpublished data) and prioritized for management (Mooers et al., 2010; Creighton and Bennett, unpublished data). However, many of the Atlantic marine species recovery documents included involvement from the Maritime Aboriginal Peoples Council, increasing the average scores. For example, the Atlantic whitefish (*Coregonus huntsman*) and Inner Bay of Fundy populations of Atlantic salmon include members from the Maritime Aboriginal Peoples Council as contributors and members of recovery teams.

Mammals had the second highest average scores, while mosses, lichens, and arthropods had the lowest scores, supporting our hypothesis of greater involvement of Indigenous Peoples in recovery documents for taxonomic groups with more iconic taxa. This reflects a consistent general pattern, with overall greater management and research activity being focused on iconic vertebrate taxa (mainly mammals and birds; Di Marco et al., 2017; Donaldson et al., 2016; Laycock et al., 2011; Martín-López et al., 2007).

We found that the agency responsible for recovery planning was strongly related to document score, with DFO receiving the highest average score of all of the agencies, and ECCC receiving a significantly lower average score than DFO or Parks Canada. This is an interesting contrast to findings by Findlay et al. (2009) that species under the responsibility of DFO were less likely to be listed as at risk, suggesting that DFO may have been failing in its duty to protect species at risk under its jurisdiction. However, Findlay et al. (2009) did state that many DFO species that were not listed were subjected to extended consultation. While this may have been seen as a delay tactic in listing species, it could also be interpreted as DFO performing their due diligence in meaningful consultation, which consequently requires more time.

The lack of correlation between document score and year published suggests that the amount of Indigenous involvement has not substantially changed over time, despite updated guidelines for Indigenous consultation in Canada along with a heightened Indigenous social movement (Government of Canada, 2011).

In addition, because SARA only requires that Aboriginal organizations be involved in recovery documents "to the extent possible" and only those organizations that the minister believes will be affected by a plan (SARA, 2002), it gives almost free rein to authors to decide what level of Indigenous involvement to include. As a result, some authors may not take the duty to consult as a serious obligation (e.g. they simply send a letter than goes unanswered), while still using the phrase "to the extent possible" to suggest that Indigenous involvement was sufficiently pursued. Furthermore, if consultation is attempted in a way that is not culturally accommodating and respectful, Indigenous Peoples may elect to not respond. In this case, cultural accommodation and a heightened respect for Indigenous knowledge and perspectives are necessary.

The lack of specific requirements for Indigenous involvement in the recovery process also leaves room for favouring some more cooperative Indigenous groups or individuals over others. There can also be divisions between Indigenous governments and their constituents that could lead to group members who have different perspectives or knowledge on a species not being consulted.

It is important to note that our study only examines whether there is evidence that Indigenous groups or individuals were involved in the development of the recovery documents. It is possible that Indigenous Peoples were involved in recovery efforts at the time of document development, and therefore may have influenced its writing, but that this is not evident in the document. In some cases, Indigenous Peoples may have been involved, but authors of the document were uncertain on what to consider Indigenous involvement for the document. In addition, we considered the statement "no comments were received" to represent declined involvement from Indigenous Peoples. It is possible that this did not represent declined involvement in certain plans; however, there is no way to know the actual reason behind the lack of responses from Indigenous Peoples for each document.

We considered co-developers and editors of plans to represent the highest level of involvement with a score of 5, because it is often the case that these roles are similar to co-authorship. It is possible that the roles of authors and editors represent different levels of involvement. However, these instances were represented by a score of 5 for the purposes of this study, since there is no clear distinction between the duties of these positions in the documents.

As noted above, surveys of recovery document authors suggested some inconsistencies between the scores obtained via document analysis and the actual level of Indigenous involvement as described by the authors. However, results of this survey generally agreed with the assigned scores, while suggesting that some scores may have been underestimated and others overestimated. On balance, we are confident that our scores reflect general patterns of Indigenous involvement among regions and taxonomic groups. We are aware that our scoring system is subjective, but our best effort was put towards ensuring its accuracy by refining its design using expert elicitation, and examining its accuracy using the author survey.

4.1. Conclusions and recommendations

To improve Indigenous involvement in the species at risk recovery process, we suggest clearer and more precise guidelines for the inclusion of Indigenous knowledge and perspectives in recovery documents. This would allow less room for author interpretation, and help to equalize effort in the pursuit of Indigenous involvement. We also suggest transparency in the way Indigenous involvement is documented. This could better highlight the value of Indigenous knowledge and perspectives within SARA. In addition, it would make the public aware of the extent of Indigenous involvement behind the recovery process. It is possible that greater scrutiny allowed by precise documentation would force agencies to a higher standard of Indigenous involvement as well. This increased transparency could perhaps include the elimination of the ambiguous phrase "to the extent possible" from the Act itself, as well as clarification about certain aspects such as personal communications and technical advisors. Clarifying the Indigenous involvement that actually took place in a required "Record of Consultation" (i.e. groups contacted, if individuals were actually spoken to, what types of information/perspectives were received and included in the recovery plan) would offer more meaning behind the phrases used to describe Indigenous involvement.

Although our survey results mostly support the scoring system and do not suggest a systematic bias toward over- or under-representation of Indigenous Peoples' involvement in recovery documents, discrepancies in the responses show that not all information and appropriate acknowledgement is being provided within recovery documents. This shows that Indigenous involvement is not always properly documented and may sometimes be overlooked or exaggerated. Responses from the author survey also showed that for some species, the responsible agency was unable to find some of the information on

Indigenous involvement. Therefore, we suggest better documentation of Indigenous involvement not just within documents, but also within the government records.

The issues of capacity or willingness of Indigenous groups to respond to consultation efforts likely do not have easy solutions. They are multi-faceted, stemming from important systemic and local issues. However, we suggest that larger Indigenous-led organizations may offer key lessons, or help play supporting roles. For example, the Maritime Aboriginal Peoples Council involvement efforts for Atlantic Canada Indigenous groups (Maritime Aboriginal Peoples Council, 2019), and could perhaps provide some lessons for additional regional Indigenous-led support for species at risk recovery partnerships. There also may be a place for a Canada-wide consultation group that could draw lessons from the COSEWIC ATK Subcommittee. We note, however, that such efforts would require considerable support. For example, COSEWIC has struggled to obtain the "best available" ATK, given logistical and financial constraints (COSEWIC, 2017).

Further research could be conducted to investigate the reasons behind the low level of Indigenous involvement in recovery plans from central Canada and Quebec. For example, a survey or a series of interviews with Indigenous Peoples in these areas could gather first-hand information on their involvement in conservation and the species at risk recovery process. This information would lead to more specific solutions on how to increase co-management between government agencies and Indigenous groups within these areas.

This study provided insight into the levels of Indigenous involvement in species at risk recovery documents throughout Canada. The low levels of involvement in central Canada (Alberta, Manitoba, and Saskatchewan) and Quebec suggest that the most work is needed in these areas in particular. The scores for Indigenous involvement are also consistent with the idea that less iconic taxa (e.g. mosses, lichens, and arthropods) are not only neglected in conservation research and prioritization, but also when eliciting Indigenous perspectives. Because the level of Indigenous involvement has not increased over time, it is clear that new specific standards need to be implemented for the process of Indigenous involvement in species at risk recovery. The significantly lower level of Indigenous involvement for species under ECCC compared to DFO and Parks Canada demonstrates that the responsible agency for the species at risk does affect the level of Indigenous Involvement. Pinpointing the areas where improvement is needed is especially important, as respect for the rights of Indigenous Peoples and the value of Indigenous knowledge is increasingly recognized.

Acknowledgements

The authors thank the following people who provided input into the scoring system: S, Cooke, Z. Todd, A. Reid, J. Kerr, H. Lickers, N. Reo, and D. Hurlburt, and all authors/contributors of species recovery documents who offered information on the consultation process. S. Cooke, A. Reid, J. Kerr and C. Mantyka-Pringle and two anonymous reviewers also provided helpful comments on earlier versions of this manuscript. CJH received financial and spiritual support from the Mohegan Tribe. JRB was supported by a Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant, and RJS was supported by a Liber Ero Fellowship.

This study contains information licensed under the Open Government License – Canada.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2019.01.017.

References

Anderson, M.J., 2001. Permutation tests for univariate or multivariate analysis of variance and regression. Can. J. Fish. Aquat. Sci. 58, 626–639.
Assembly of First Nations, 2009. Assembly of First Nation Species at Risk Act Survival Guide. http://www.afn.ca/uploads/files/env/sara-guide.pdf.
Assembly of First Nations, 2010. An Analysis of the Species at Risk Act Policies on the Conservation Cycle. https://www.afn.ca/uploads/files/env/10-11-16_sara_policies_aquatics.pdf.
Ayers, C.A., 2005. Marine Conservation from a First Nations' Perspective : A Case Study of the Principles of the Hul' Qumi' Num of Vancouver Island, British Columbia.
Bains, R., Ishkanian, K., 2016. The Duty to Consult with Aboriginal Peoples: A Patchwork of Canadian Policies. The Fraser Institute.
Bonnet, X., Shine, R., Lourdais, O., 2002. Taxonomic Chauvinism. Trends Ecol. Evol. 17 (1), 1–3.
Buchanan, N., 2016. Which fish? Knowledge, articulation, and legitimization in claims about endangered and culturally significant animals. Sci. Technol. Hum. Values 42 (3), 520–542.
Colchester, M., 2004. Conservation policy and Indigenous peoples. Environ. Sci. Policy 7 (3), 145–153.
Corntassel, J., 2007. Partnership in action? Indigenous political mobilization and Co-optation during the first UN Indigenous decade (1995-2004). Hum. Rights Q. 29, 137–166.
Creighton, M. J. A., and J. R. Bennett. Taxonomic biases from listing to management for Canadian species at risk of extinction. unpublished data.
Di Marco, M., Chapman, S., Althor, G., Kearney, S., Besancon, C., Butt, N., Maina, J.M., et al., 2017. Changing trends and persisting biases in three decades of conservation science. Glob. Ecol. Conserv. 10, 32–42.
Donaldson, M.R., Burnett, N.J., Braun, D.C., Suski, C.D., Hinch, S.G., 2016. Taxonomic Bias and international biodiversity conservation research. Facets 1, 105–113.
Environment and Climate Change Canada, 2017. Unpublished Data on Species at Risk Ranges in Canada. [Data file]. Retrieved from. http://donnees.ec.gc.ca/data/species/protectrestore/range-map-extents-species-at-risk-canada/.
Findlay, C.S., Elgie, S., Giles, B., Burr, L., 2009. Species listing under Canada's Species at Risk Act. Conserv. Biol. 23 (6), 1609–1617.
Government of Canada, 2002. Species at Risk Act. Minister of Justice.
Government of Canada, 2010. Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Aboriginal Traditional Knowledge (ATK) Process and Protocols Guidelines.
Government of Canada, 2011. Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult.
Government of Canada, 2017. COSEWIC Annual Report 2016-2017.
Haida Nation v. British Columbia (Minister of Forests), 2004. 3 S.C.R. 511, 2004 SCC 73.
Holm, S., 1979. A simple sequentially rejective multiple test procedure. Scand. J. Stat. 6, 65–70.
Joseph, B., 2015. 12 Common Mistakes in First Nation Consultation. July 02 Accessed March 23, 2018. Indigenous Corporate Training Inc.. https://www.ictinc.ca/blog/12-common-mistakes-in-first-nation-consultation.
Laycock, H.F., Moran, D., Smart, J.C.R., Raffaelli, D.G., White, P.C.L., 2011. Evaluating the effectiveness and efficiency of biodiversity conservation spending. Ecol. Econ. 70, 1789–1796.
Leroy, S., Dobell, R., Dorcey, T., Tansey, J., 2003. Public process and the creation of the Race Rocks marine protected area. Georgia Basin/Puget Sound Research Conference. pp. 1–12.
Macdonald, N., 2015. Welcome to Winnipeg: where Canada's racism problem is at its worst. Maclean's. January. Accessed Sept. 6, 2018. https://www.macleans.ca/news/canada/welcome-to-winnipeg-where-canadas-racism-problem-is-at-its-worst/.
Maritime Aboriginal Peoples Council, 2014. Case Study on Consultation, Accommodation and Cooperation With Aboriginal Peoples Undertaken by Environment Canada in Regard to the Boreal Woodland Caribou, and by Fisheries and Oceans Canada in Regard to the Inner Bay of Fundy Atlantic Salmon and American Eel; and Identification Gaps and Suggestions to Increase the Level of Aboriginal Participation in the Species at Risk Act.
Maritime Aboriginal Peoples Council, 2019. SAR IKANAWTIKET. Accessed January 24. https://mapcorg.ca/sar-ikanawtiket/.
Martín-López, B., Montes, C., Benayas, J., 2007. The non-economic motives behind the willingness to pay for biodiversity conservation. Biol. Conserv. 139 (1–2), 67–82.
Mooers, A.Ø, Prugh, L.R., Festa-Bianchet, M., Hutchings, J.A., 2007. Biases in legal listing under Canadian endangered species legislation. Conserv. Biol. 21 (3), 572–575.
Mooers, A.Ø, Doak, D.F., Findlay, C.S., Green, D.M., Grouios, C., Manne, L.L., Rashvand, A., Rudd, M.A., Whitton, J., 2010. Science, policy, and species at risk in Canada. BioScience 60 (10), 843–849.
Moore, M., Von Der Porten, S., Castleden, H., 2017. Consultation is not consent: hydraulic fracturing and water governance on Indigenous lands in Canada. WIREs Water 4, 1–15.
Natural Resources Canada, 2014. Aboriginal Lands of Canada. [WWW Document]. URL. http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/815dd99d-4fbd-47cc-be02-7ad4b03a23ec.html#distribution.
Raymond, C.V., Wen, L., Cooke, S.J., Bennett, J.R., 2018. National attention to endangered wildlife is not affected by global endangerment: a case study of Canada's species at risk program. Environ. Sci. Policy 84, 74–79.
Smith, M.A., 2015. A reflection on First Nations in their boreal homelands in Ontario: between a rock and a caribou. Conserv. Soc. 13 (1), 23.
Urban Aboriginal Peoples Study, 2011. Regina Report. [online]. Environics Institute, Toronto. p. 37. Available at: http://www.uaps.ca/wpcontent/uploads/2010/02/UAPS-Regina-Final-Report2.pdf (Accessed 7 February 2018).
Walker, P., 2001. Journeys around the medicine wheel: A story of Indigenous research in a western University. Aust. J. Indig. Educ. 29 (2), 18–21.